

EOS Mission Support Network Performance Report

This is a monthly summary of EMSnet performance testing -- comparing the measured performance against the requirements.

Highlights:

- Test results remain stable – **all "adequate" or better since December '03!**
- Results from the "Integrated" data calculations are now shown below. The "Integrated" results are generally lower than the sum of the median iperf throughput and the average MRTG. See the discussion on this topic last month, and further info this month.

Ratings:

Rating Categories:

Excellent : Total Kbps > Requirement * 3
Good : $1.3 * \text{Requirement} \leq \text{Total Kbps} < \text{Requirement} * 3$
Adequate : Requirement < Total Kbps < Requirement * 1.3
Low : Total Kbps < Requirement.
Bad : Total Kbps < Requirement / 3

Where Total Kbps = User Flow + iperf monthly average

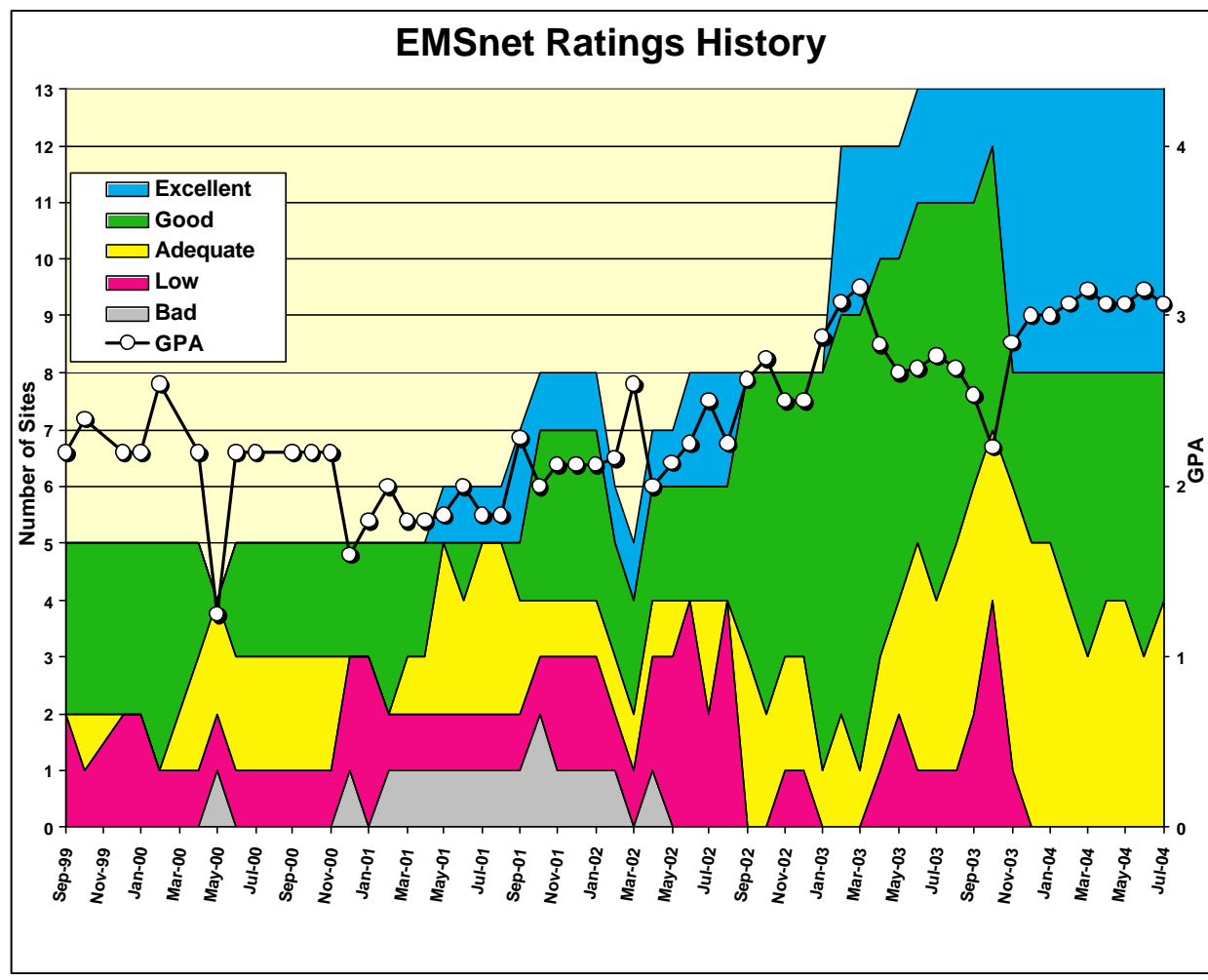
Ratings Changes:

Upgrades: ↑:

NSIDC → GSFC: Adequate → **Good**

Downgrades: ↓:

US → JAXA: Good → **Adequate**
GSFC → EDC: Good → **Adequate**

Ratings History:

The chart above shows the number of sites in each classification since EMSnet testing started in September 1999.

Note that these ratings do NOT relate to absolute performance -- they are relative to the EOS requirements. The GPA is calculated based on Excellent: 4, Good: 3, Adequate: 2, Low: 1, Bad: 0

Integrated Testing Results:

This month additional "integrated" results are again presented for selected tests (in addition to the previous results) (See the more detailed discussion in last month's report). The integrated results seem quite credible, and are being considered to replace the MRTG + iperf sum in the future

Overview

In the existing method, a circuit is characterized by combining the iperf "thruput" and MRTG "user flow". Clearly neither the thruput nor the MRTG can fully represent the capability of a circuit. User flow alone is incomplete, since there may be low user demand during a measurement period. But if user flow is high, then iperf will compete for bandwidth with it, and the iperf results will be reduced. So the iperf must be combined with the user flow to accurately characterize the performance of a circuit. The current method is to add the monthly median iperf thruput value to the adjusted monthly average MRTG value for the appropriate circuit.

But the user flow will only partially affect those iperf tests which occur at the same time, while the iperf tests will not have much long term affect on user flow. Thus the sum of these values will tend to overstate the actual circuit capability.

Integrated methodology:

With the use of ENSIGHT, additional information is collected and available in the database. The additional information is derived from statistics gathered from the routers measuring the user flow during each individual iperf test. With adjustments for "interference", this is used to derive an improved estimate of the circuit performance.

Results:

The following table summarizes the results of both methods:

Row	Source → Dest	Iperf	User flow	Total	Integrated
1	GSFC-PTH → EDC-PTH	209.6	133.5	343.1	285.5
2	GSFC-CSAFS → JPL-SEAPAC	6.08	0.77	6.86	6.17
3	LaRC DAAC → JPL-TES	40.03	5.63	45.66	40.03
4	GSFC-PTH → NSIDC	91.0	6.8	97.8	91.3
5	GSFC-CSAFS → NESDIS	2.93	0.22	3.15	2.93
6	GDAAC → LDAAC	51.6	15.5	67.1	55.4
7	GSFC-CSAFS → JAXA-EOC	2.03	0.50	2.53	2.14

Discussion:

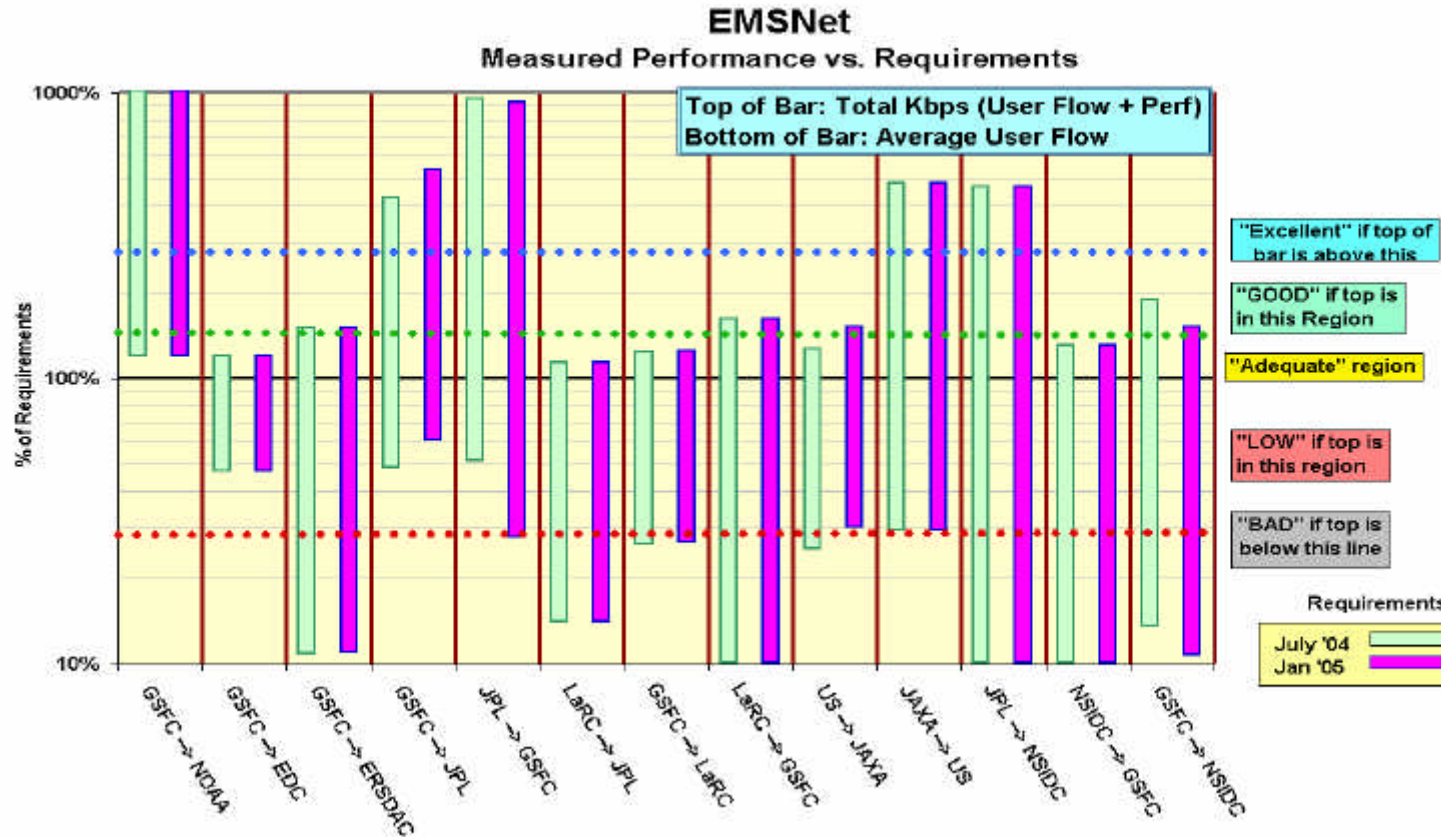
In each case above, the "Integrated" value is lower than the "Total" obtained by adding the median monthly iperf to the adjusted average MRTG. This difference now seems likely to be that user flow does not affect iperf nearly as much as the monthly "average" user flow value. So the Integrated measurements, using flow measurements during individual iperf tests (with an improved adjustment for "interference"), are therefore now considered to be superior to the previous method.

EMSnet Sites

Network Requirements vs. Measured Performance

July 2004		Requirements (kbps)		Testing								
Source → Destination	Team (s)	Current	Future	Source → Dest Nodes	Raw MRTG	Perf → MRTG	Avg User Flow kbps	iperf Avg kbps	Total Avg kbps	Rating re Current Requirements		Rating re
		Jul-04	Jan-05							Jul-04	Prev	Jan-05
GSFC → ASF	QuikScat, Radarsat	n/a	n/a	GSFC-CSAFS → ASF	27	18	7	1090	1097	n/a	n/a	n/a
ASF → JPL	QuikScat, Radarsat	n/a	n/a	ASF → JPL-SEAPAC	240	21	207	1253	1460	n/a	n/a	n/a
GSFC → NOAA	QuikScat	189	189	GSFC-CSAFS → NESDIS	314	73	225	2929	3154	Excellent	E	Excellent
GSFC → EDC	MODIS, LandSat	285361	285361	GSFC-PTH → EDC PTH	147900	6986	133519	209587	343105	Adequate	G	Adequate
GSFC → ERSDAC	ASTER	568	568	GDAAC → ERSDAC	71	7	61	786	847	GOOD	G	GOOD
GSFC → JPL	ASTER, QuikScat, MLS, etc.	1597	1275	CSAFS → JPL-SEAPAC	954	135	771	6084	6855	Excellent	E	Excellent
JPL → GSFC	AMSR, etc.	625	1155	JPL-PODAAC → GDAAC	515	170	319	12235	12554	Excellent	E	Excellent
LaRC → JPL	TES, MISR	40311	40311	LDAAC → JPL-TES	6275	334	5627	40033	45660	Adequate	A	Adequate
GSFC → LaRC	CERES, MISR, MOPITT	59401	58456	GDAAC → LDAAC	16800	430	15530	51598	67128	Adequate	A	Adequate
LaRC → GSFC	MODIS, TES	31784	31695	LDAAC → GDAAC	760	424	298	50855	51153	GOOD	G	GOOD
US → JAXA	QuikScat, TRMM, AMSR	1986	1665	GSFC-CSAFS → JAXA	561	34	499	2029	2527	Adequate	G	GOOD
JAXA → US	AMSR	512	512	JAXA → JPL-SEAPAC	198	39	150	2318	2468	Excellent	E	Excellent
JPL → NSIDC	AMSR	1342	1342	JPL-PODAAC → NSIDC SIDADS	180	52	119	6205	6324	Excellent	E	Excellent
NSIDC → GSFC	MODIS, ICESAT, QuikScat	13326	13326	NSIDC DAAC → GDAAC	631	141	458	16943	17401	GOOD	A	GOOD
GSFC → NSIDC	MODIS, ICESAT, QuikScat	51157	64118	GSFC-PTH → NSIDC DAAC	8000	750	6850	89943	96793	GOOD	G	GOOD
Notes: Flow Requirements (from BAH) include TRMM, Terra, Aqua, QuikScat, ADEOS-II										Ratings Summary		
										Jul-04 Score	Reg Prev	Jan-05 Score
*Criteria:	Excellent	Total Kbps > Requirement * 3								Excellent	5	5
	GOOD	1.3 * Requirement ≤ Total Kbps < Requirement * 3								GOOD	4	5
	Adequate	Requirement < Total Kbps < Requirement * 1.3								Adequate	4	3
	LOW	Total Kbps < Requirement								LOW	0	0
	BAD	Total Kbps < Requirement / 3								BAD	0	0
										Total	13	13
										GPA	3.08	3.15

This graph shows two bars for each source-destination pair. Each bar uses the same actual measured performance, but compares it to the requirements for two different times (June '04, and October '04). Thus as the requirements increase, the same measured performance will be lower in comparison.



Note that this chart shows that the performance to all sites meets current requirements

Interpretation: The bottom of each bar is the average measured MRTG flow to a site. Thus the bottom of each bar indicates the relationship between the requirements and actual flows. Note that the requirements include a 50% contingency factor above what was specified by the projects, so a value of 66% would indicate that the project is flowing as much data as requested. The top of each bar represents the sum of the MRTG user flow plus the iperf measurement – it is this value which is used as the basis of the ratings

1) ASFRating: **N/A**Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/ASF_EMS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → ASF	1.35	1.09	0.49	0.007	1.10	1.11
ASF → NESDIS	1.37	1.05	0.32	0.21	1.26	
ASF → NSIDC	1.40	1.15	0.40			
ASF → GSFC-CSAFS	1.40	1.17	0.38			
ASF → JPL-SEAPAC	1.38	1.25	0.36			

Comments: On approx June 3, the JPL ? ASF circuit was reduced from 2 T1s to a single T1. Thruput peaks were about the same as last month, but the medians and daily worst dropped somewhat to all destinations. The 1.26 mbps total from ASF → NOAA is as expected for a single T1 (1.54 mbps) circuit. The other ASF outflows are comparable.

The requirement was from ADEOS, and has been deleted. The remaining ASF requirements are very low, and are mostly based on estimated ECS interDAAC queries, not production flows. These flow estimates are not considered reliable enough to use as a basis for testing, so the rating is "N/A".

2) GSFC → EDC:Rating: ↓ Good → **Adequate**Web Page: <http://ensight.eos.nasa.gov/Networks/emsnet/EDC.shtml>

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-PTH → EDC-PTH	219.5	209.6	196.5	133.5	343.1	285.5
G-DAAC → EDC LPDAAC	208.2	175.6	137.8			

Requirements:

Date	mbps	Rating
July 04, Jan '05	285.4	Adequate

Comments:

The rating is based on testing between the GSFC performance test host ("GSFC-PTH"), located outside the ECS firewall and the EDC performance test host ("EDC-PTH"), also located outside the ECS firewall. The comparison of the two results above shows the effect of high levels of loading on the GDAAC and the ECS firewalls. This month the iperf increased a bit, but the MRTG user flow decreased from 172 mbps last month. The 343 mbps sum exceeds the requirement, but not by a 30% margin, so the rating drops to "Adequate".

The new "Integrated" measurement is presented above, which combines each iperf test with user flow data for the same time period. There is a larger difference this time (17%, compared to only 2% last time). This may be due to the small effect that moderate user flows have on iperf measurements. If so, it may indicate that the previous method – adding the iperf and user flow – overstates the network capability.

3) JPL:

Ratings: GSFC → JPL: Continued **Excellent**
 JPL → GSFC: Continued **Excellent**
 LaRC → JPL: Continued **Adequate**

Web Pages:

http://ensight.eos.nasa.gov/Networks/emsnet/JPL_SEAPAC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/JPL_PODAAC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/JPL_TES.shtml
http://ensight.eos.nasa.gov/Missions/terra/JPL_MISR.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → JPL-SEAPAC	6.26	6.08	3.35	0.77	6.86	6.17
LaRC DAAC → JPL-TES	40.39	40.03	21.05	5.63	45.66	40.03
LaRC DAAC → JPL-MISR (ftp)	20.08	19.59	8.51			
JPL-PODAAC → GSFC DAAC	12.31	12.23	7.78	0.32	12.55	

Requirements:

Source → Dest	Date	mbps	Rating
GSFC → JPL combined	July '04	1.60	Excellent
JPL → GSFC combined	July '04	0.63	Excellent
LaRC DAAC → JPL-TES	July '04	30.6	Adequate
LaRC DAAC → JPL-MISR	July '04	18.5	Adequate
LaRC DAAC → JPL-Combined	July '04	49.1	Low

Comments:

GSFC → JPL: Performance on this circuit has been mostly stable since the BOP switchover on 15 August '02; well above the requirement; the rating remains "Excellent". The new "integrated" data here, like EDC, combines the iperf and user flow for each individual test. In this case the integrated result is just slightly higher than the iperf results alone, and substantially lower than the sum of the median iperf and average MRTG. This seems to indicate that a small average user flow added to the median iperf to the average MRTG overstates the true situation.

LDAAC → JPL: Performance testing from LDAAC to JPL-TES has been stable at 40 mbps since testing was restored on Feb 29. Iperf testing to JPL-MISR has been blocked by JPL security, and did not recover until August. So the MISR results above are from ftp testing, which is limited to about half the typical iperf performance due to TCP window size and RTT factors. This ftp performance has also been stable. The integrated result in this case is also well below the sum of the median iperf and average MRTG.

Note: The measured thrupt is above both the MISR and TES requirements, but below their combined value. However, the MISR requirement is open to some interpretation. The formal QA flow is only 9.7 mbps. But the science data also flows on the same circuit. This pushes the total MISR flow requirement to 18.5 mbps. When this 18.5 mbps MISR requirement is added to the 30.6 mbps TES requirement, the 49 mbps total requirement is higher than the measured performance, and also higher than the nominal circuit speed. Thus the rating remains "Low". But the rating would be "Adequate" based only on the formal QA requirement.

This configuration is based on a management decision to set the circuit capacity at this level to reduce cost, in the expectation that both projects' requirements are bursty and include contingency. Thus the actual requirements of both projects are expected to be met with this circuit capacity.

JPL → GSFC: The requirement from JPL to GSFC includes flows from NASDA and ASF which go via JPL, and includes GSFC and NOAA destinations. Since many of these flows were related to ADEOS, this requirement dropped substantially with the removal of ADEOS. The iperf flow increased abruptly from a stable 8 mbps to a stable 12 mbps on March 6, apparently due to a PVC change. The combined requirement is now only 0.63 mbps, and the combined 12.6 mbps thrupt is more than 3 times that, so the rating remains "Excellent".

4) NSIDC:Ratings: GSFC → NSIDC: Continued **Good**NSIDC → GSFC: ↑ Adequate → **Good**Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/NSIDC_EMS.shtml**GSFC ↔ NSIDC Test Results:**

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-PTH → NSIDC	91.8	91.0	52.7	6.8	97.8	91.3
GSFC-DAAC → NSIDC	91.4	91.0	45.5			
NSIDC → GSFC-DAAC	17.0	16.9	15.9	0.5	17.4	

Requirements:

Source → Dest	Date	mbps	Rating
GSFC → NSIDC	July '04	51.1	Good
NSIDC → GSFC	July '04	13.3	Good

Comments:

GSFC → NSIDC: The rating is based on testing from the GSFC-PTH to the NSIDC DAAC. This node is outside the GSFC ECS firewall, and has the same peaks and median, but slightly higher daily worst values compared to the GDAAC. The performance is more than 30% above the requirement, so the rating remains "Good". The requirement varies from month to month based on planned ICESAT reprocessing. Like EDC and JPL, the new "Integrated" results are close to the iperf results, and substantially lower than the sum of the median iperf and average MRTG

NSIDC → GSFC: Performance from NSIDC to GSFC improved very slightly, but crossed the boundary to "Good".

Other Testing:

Source → Dest	Medians of daily tests (mbps)			Requirement	Rating
	Best	Median	Worst		
JPL → NSIDC-SIDADS	6.21	6.21	4.39	1.08	Excellent
GSFC-ISIPS → NSIDC (ftp)	1.75	1.45	1.23		
GSFC-ISIPS → NSIDC (iperf)	7.70	6.74	5.66		
NSIDC → GSFC-ISIPS (iperf)	17.11	17.02	15.91		
LDAAC → NSIDC	4.94	4.79	4.63	0.07	Excellent
ASF → NSIDC	1.40	1.15	0.40	0.73	Good

Comments:

JPL → NSIDC-SIDADS: Performance has been very steady from JPL since the Aug '02 BOP switchover, exceeding the modest requirement.

GSFC-ISIPS ↔ NSIDC: Performance from ISIPS to NSIDC – both ftp and iperf -- had a step drop on July 12 (medians were 7 mbps for ftp and 35 mbps for iperf until that date). It appears that send window scaling has been disabled on the ISIPS HP-UX machine. Testing from NSIDC to ISIPS was not affected, and gets very similar thrupt as NSIDC to GDAAC.

LDAAC → NSIDC: Thrupt from LDAAC to NSIDC has been steady since August '03. The very low requirement produces a rating of "Excellent".

ASF → NSIDC: The median thrupt remains more than 30 % above the LASP requirement, but not by a factor of 3 any more, so the rating continues "Good".

5) GSFC ↔ LaRC:

Ratings: GDAAC → LDAAC: Continued **Adequate**
 LDAAC → GDAAC: Continued **Good**

Web Page: <http://ensight.eos.nasa.gov/Networks/emsnet/LARC.shtml>

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GDAAC → LDAAC	55.6	51.6	30.2	15.5	67.1	55.4
GSFC-PTH → LDAAC	58.8	57.7	21.6			
GSFC-PTH → LaTIS	58.8	57.6	23.1			
LDAAC → GDAAC	51.1	50.9	43.8	0.3	51.2	50.9

Requirements:

Source → Dest	Date	Mbps	Rating
GDAAC → LDAAC	July '04	58.4	Adequate
LDAAC → GDAAC	July '04	31.7	Good

Comments: **GSFC → LaRC:** Performance from GDAAC to LDAAC increased a bit (was 49 mbps last month), user flow dropped from 22 mbps last month, for a small net decrease, with the rating still "Adequate". Testing from GSFC-PTH to LDAAC and from GSFC-PTH to LaTIS is very similar to testing from GDAAC to LDAAC. . Like JPL, the new "Integrated" results are substantially lower than the sum of the median iperf and average MRTG

LaRC → GSFC: Performance remains stable since the June '03 upgrade to meet the backhaul requirements. The FY '04 requirement jumped from 6.8 mbps to 31.7 mbps in Oct '03, to incorporate this backhaul of all LaRC science outflow via GSFC (which has apparently not started thus far). The thruput is more than 30% above this requirement, so the Jan '04 rating remains "good".

6) NOAA NESDIS:

Rating: Continued **Excellent**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/NOAA_NESDIS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → NESDIS	2.93	2.93	1.64	0.22	3.15	2.93
ASF → NESDIS	1.37	1.05	0.32			
JAXA (NASDA) → NESDIS	1.61	1.59	0.78			

Requirements:

Source → Dest	FY	Mbps	Rating
GSFC-CSAFS → NESDIS	'04	0.19	Excellent

Comments: With the deletion of the ADEOS flows from ASF, the dominant flow to NOAA is Quikscat data, from GSFC CSAFS.

Like other sites, the new "Integrated" results are substantially lower than the sum of the median iperf and average MRTG. In this case the 3.15 mbps total iperf + user flow exceeds the 2 x T1 circuit capacity, so the integrated results are considered to be more accurate. Since the thruput is more than 3 times the FY '04 requirement, the rating is "Excellent".

Also note that the flow from NASDA is limited by the TCP window size of the NASDA test source, and the long RTT.

7) US ↔ JAXA (NASDA):

Ratings: GSFC → JAXA: ↓ Good → **Adequate**
 JAXA → US: Continued **Excellent**

Web Pages http://ensight.eos.nasa.gov/Networks/emsnet/NASDA_EOC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/JPL_SEAPAC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/GSFC_SAFS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → JAXA-EOC	2.27	2.03	1.42	0.50	2.53	2.14
JAXA-EOC → JPL-SEAPAC	2.33	2.32	1.26	0.15	2.47	
JAXA-EOC → GSFC-CSAFS	1.44	1.41	0.83			

Requirements

Source → Dest	Date	mbps	Rating
GSFC → JAXA	July '04	1.99	Good
JAXA → US	FY '03, '04	0.51	Excellent

Comments: US → JAXA: The requirements above were reduced in November '03, due to the removal of ADEOS flows. Performance was steady this -- about as expected for the 3 mbps ATM PVC (using multiple TCP streams to mitigate the TCP window size limitation at JAXA). However, the user flow dropped this month, with the iperf + MRTG total now slightly less than 30% above the requirement, dropping the rating to "Adequate". Like most other sites, the new "Integrated" results are substantially lower than the sum of the median iperf and average MRTG.

Note: The requirement still includes 4 ISTs at JAXA for AMSR-E. Each IST has a requirement for 311 kbps, for a total of 1244 kbps. It could be questioned whether JAXA intends to operate all four of the ISTs simultaneously, or whether some ISTs are backups, in which case the network requirements would be reduced to a lower value.

JAXA → US: Performance continues very stable. The requirement was reduced in November '03 due to the removal of ADEOS requirements, increasing the rating to "Excellent".

Note: JAXA has not yet implemented testing with multiple tcp streams, so performance to GSFC is limited by the TCP window size on JAXA's test machine, in conjunction with the long RTT. In order to reflect the actual capability of network, the rating is derived from testing from JAXA to JPL, which uses the same Trans-Pacific circuit, but has a shorter RTT, so will not be limited by the TCP window size. The Trans-Pacific circuit connects into the higher speed domestic EMSnet at JPL, which is not expected to be the limiting factor.

8) GSFC → ERSDAC:

Rating: Continued **Good**

Web Page: <http://ensight.eos.nasa.gov/Networks/emsnet/ERSDAC.shtml>

Test Results:

Source → Dest	Medians of daily tests (kbps)			User Flow	TOTAL
	Best	Median	Worst		
GSFC → ERSDAC	792	786	532	61	845

Requirements:

Source → Dest	FY	Kbps	Rating
GSFC → ERSDAC	'03, '04	568	Good

Comments: Thruput since June '02, using the 1 mbps ATM connection had been very stable (except for a problem period from 12 November '02 to 3 Jan '03). The requirement was revised down from 668 kbps in November '03, so the total user flow plus iperf is more than 30 % over the requirement, and the rating remains "Good".